

How We Use

Raintree
Perspectives

Rubber





Mississauga
Library
System

CHURCHILL
MEADOWS

How We Use

Rubber

Chris Oxlade



Chicago, Illinois

© 2005 Raintree
Published by Raintree,
A division of Reed Elsevier, Inc.
Chicago, IL

All rights reserved. No part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photography, recording, taping, or any information storage and retrieval system, without permission in writing from the publishers.

For information, address the publisher:
Raintree
100 N. LaSalle, Suite 1200
Chicago, IL 60602

Originated by Ambassador Litho
Printed and bound in China by
South China Printing Company

09 08 07 06 05
10 9 8 7 6 5 4 3 2 1

Library of Congress Cataloging-in-Publication Data

Oxlade, Chris.

How we use rubber / Chris Oxlade.

p. cm. -- (Using materials)

Includes bibliographical references and index.

ISBN 1-4109-0604-3 -- ISBN 1-4109-0895-X

1. Rubber--Juvenile literature. 2. Rubber--Juvenile literature. I. Title. II. Series.

TS1890.O95 2004

678'.2--dc22

Acknowledgments

The publisher would like to thank the following for permission to reproduce photographs: pp. 4 (Tony Craddock), 11 (Maximillian Stock), 13 (Professor Harold Edgerton), 17 (Martyn F. Chillmaid), 18 (Novosti Press Agency) Science Photo Library; pp. 5 (Harcourt Index), 20 (Volker Möhrke), 23 (Harcourt Index) Corbis; pp. 6, 7 (J. Wakelin), 26 (D. Hastilow), 29 (B. Turner) Art Directors & Trip; pp. 8 (Harcourt Index), i, 21 (Harcourt Index) Photodisc; pp. 9 (The Picture Source), 19 (Alan Spence), 24 (JRCpix.com/Jonah Calinawan) photographersdirect.com; p. 10 Robert Harding Picture Library; pp. 12 (Pixel), 16 (Pixel) Powerstock; pp. 14, 27 Alamy Images; p. 15 Alvey & Towers; p. 22 (Daybreak Imagery) Oxford Scientific Films; p. 25 Gareth Boden; p. 28 Sutton Motorsport.

Cover photograph of tread on a rubber tire reproduced with permission of Rex Features.

Every effort has been made to contact copyright holders of any material reproduced in this book. Any omissions will be rectified in subsequent printings if notice is given to the publishers.

2004002916

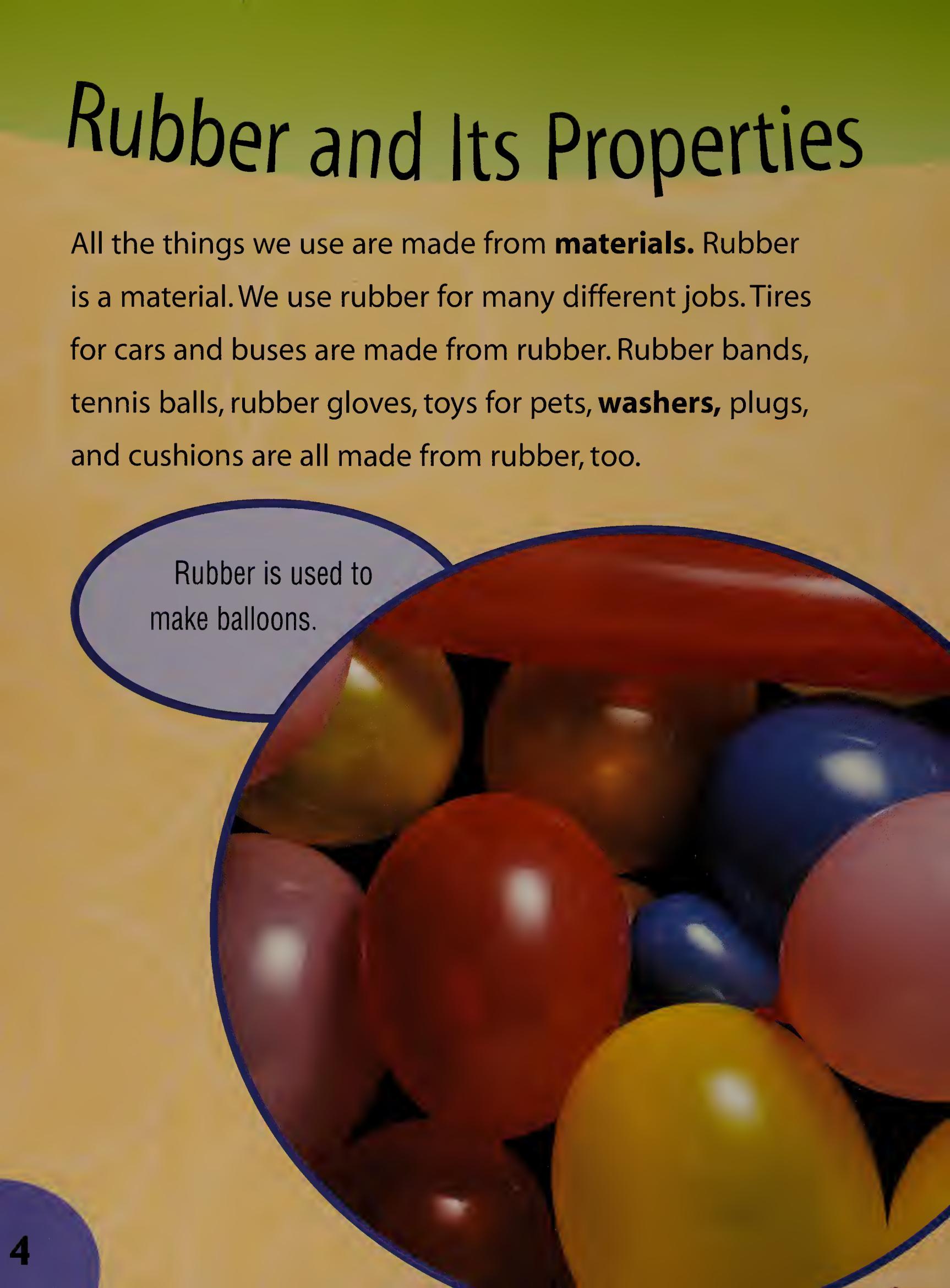
Contents

Rubber and Its Properties	4
Where Does Rubber Come From?	6
Synthetic Rubber	8
Working with Rubber	10
Stretchy Rubber	12
Shock-Absorbing Rubber	14
Rubber for Friction	16
Rubber Tires	18
Tough Rubber	20
Waterproof Rubber	22
Sealing with Rubber	24
Sponge and Foam Rubber	26
Rubber and the Environment	28
<i>Find Out for Yourself</i>	30
<i>Glossary</i>	31
<i>Index</i>	32

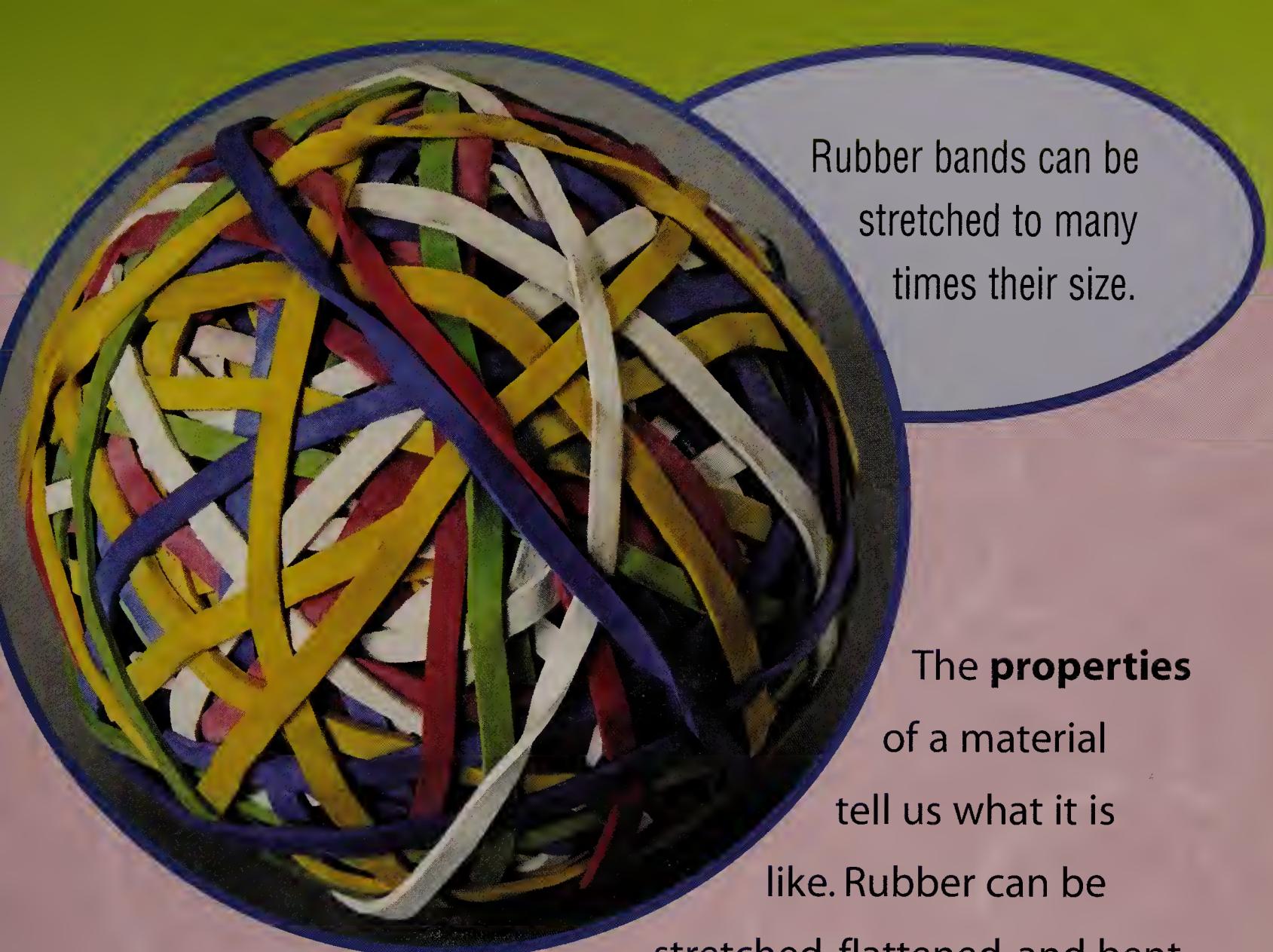
Some words appear in bold, **like this**. You can find out what they mean by looking in the glossary.

Rubber and Its Properties

All the things we use are made from **materials**. Rubber is a material. We use rubber for many different jobs. Tires for cars and buses are made from rubber. Rubber bands, tennis balls, rubber gloves, toys for pets, **washers**, plugs, and cushions are all made from rubber, too.



Rubber is used to make balloons.



Rubber bands can be stretched to many times their size.

The **properties** of a material tell us what it is like. Rubber can be stretched, flattened, and bent.

It is also tough and lasts a long time. Rubber is **waterproof** and **airtight**. It is also an **insulator**, which means it does not let electricity flow through it.

Do not use it!

The different properties of materials make them useful for some jobs. The properties also make them unsuitable for other jobs. For example, rubber is bendable, so we do not make knives from rubber. They would not cut anything!

Where Does Rubber Come From?

Some of the rubber we use is natural. It comes from trees called rubber trees that grow in **tropical** areas of the world. Rubber is part of a **liquid** called **latex**.

Latex is found in the bark of these trees. Latex is a mixture of rubber and water. Thousands of rubber trees are grown in **plantations** to make latex.

This picture shows how latex is collected from rubber trees growing on a plantation.



Natural rubber must be rolled to squeeze out the water.



Collecting latex from a tree is called tapping. Workers make cuts into the bark of rubber trees. The latex seeps out of the bark and slowly runs down the cuts into cups.

Chemicals are added to the latex. These chemicals make the rubber clump together.

The liquid is **strained** to remove the lumps of rubber.

- The rubber is then pressed and dried to make sheets.

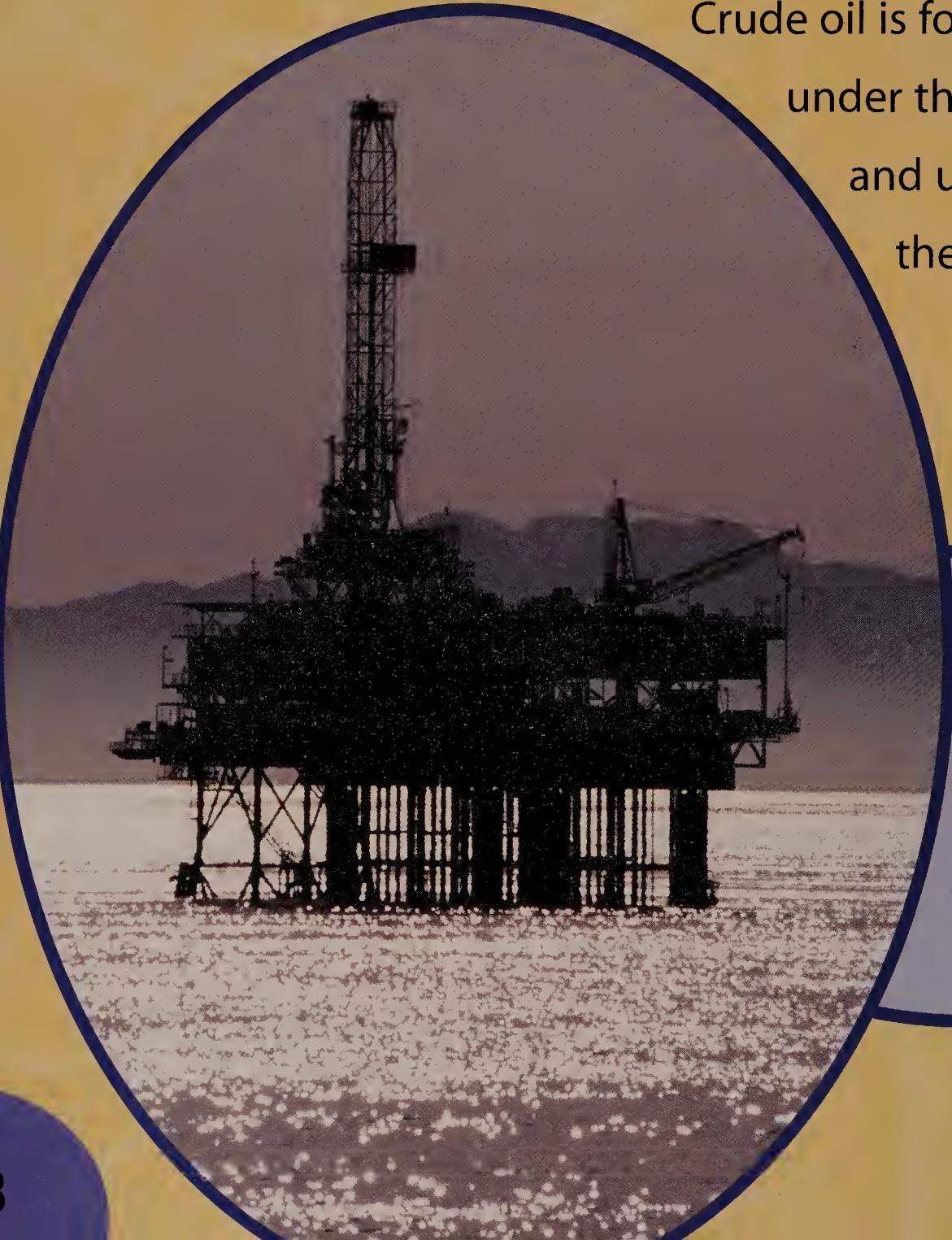
These sheets are made into rubber objects.

Rubber in the past

*People have known about rubber for hundreds of years. One of its first uses was for erasers for rubbing out pencil marks. Rubber became even more useful when scientists figured out how to make it stronger. It could then be used to make tough **waterproof** seals inside machines.*

Synthetic Rubber

Natural rubber is an important **material**. But most rubber we use today is not natural. It is made in factories from **chemicals**. It is called **synthetic** rubber. The chemicals used to make synthetic rubber come from **crude oil**.



Crude oil is found
under the ground
and under
the seabed.

This rig brings
crude oil from
under the seabed
to the surface.



These lumps of synthetic rubber will be used to make many different rubber objects.

Rubber factories use different mixtures of chemicals to make different types of rubber. Scientists are always trying to make synthetic rubbers with new and better **properties**. These are called special rubbers. A special rubber might not melt in the very high heat of an oven or crack in the very low coldness of a freezer.

Do not use it!

*Synthetic rubber and natural rubber are harmed by some substances. **Gases**, oils, and sunlight make them weaken and crack. We must use special rubber for jobs in which the rubber will touch these substances, such as in gas pipes.*

Working with Rubber

Rubber comes from factories in lumps or sheets. Before rubber is made into objects, it is turned into soft lumps.

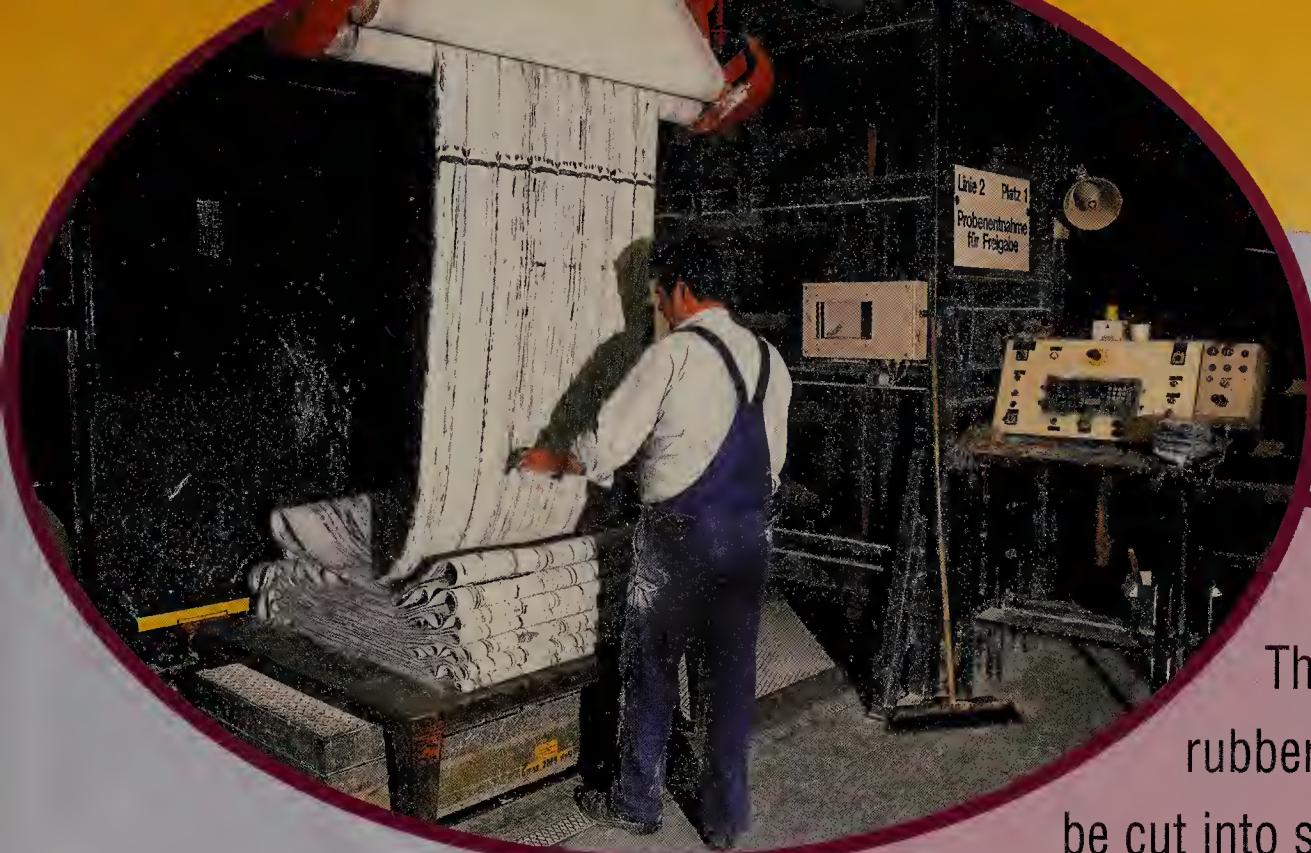
This is done by heating and stirring it.

Other substances can be added to the rubber to change its **properties**.

These can make it more **elastic** or tougher. The soft rubber is then turned into objects.



Rubber gloves like these are made by dipping hand-shaped molds into liquid rubber.



This sheet of rubber is ready to be cut into shapes.

Objects such as tires and hot-water bottles are made by pressing soft rubber into a **mold**. The hole in the mold is the same shape as the object. Tubes and door seals are made by pushing soft rubber through a hole. **Washers** and mats are made by cutting shapes from rubber sheets.

Making rubber tough

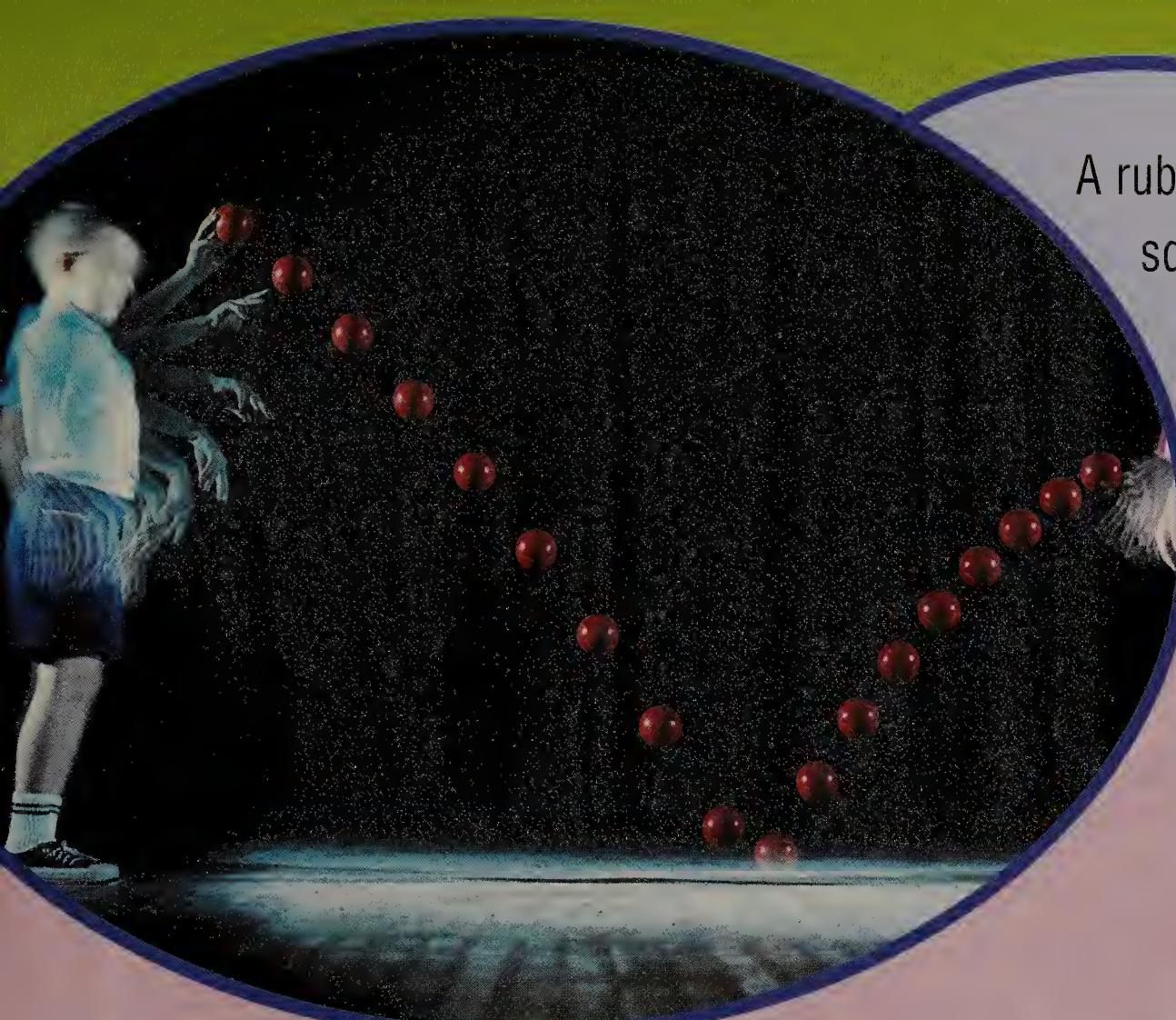
*To make rubber harder and tougher, it is heated with a **chemical** called **sulfur** and then cooled. This process is called **vulcanization**. Almost all the rubber we use is vulcanized.*

Stretchy Rubber

Rubber is an **elastic material**. This means you can stretch, flatten, or bend it. Rubber will also go back to its original shape when you let go. You can stretch, flatten, or bend a piece of rubber thousands of times without it breaking. This **property** makes rubber useful for thousands of jobs.



Elastic bands
are useful for
holding things
in place.



A rubber ball is squashed as it hits the ground.

A rubber band can stretch to many times its original length without breaking. The rubber used in a tennis ball is squashed as it hits the ground. It then springs back into its original shape and bounces. Rubber is also used to make elastic cord for clothes and elastic bandages.

Do not use it!

Being elastic is a very useful property of rubber. For many jobs, however, we want a material that does not stretch, so we cannot use rubber. For example, we do not use rubber to make road bridges.

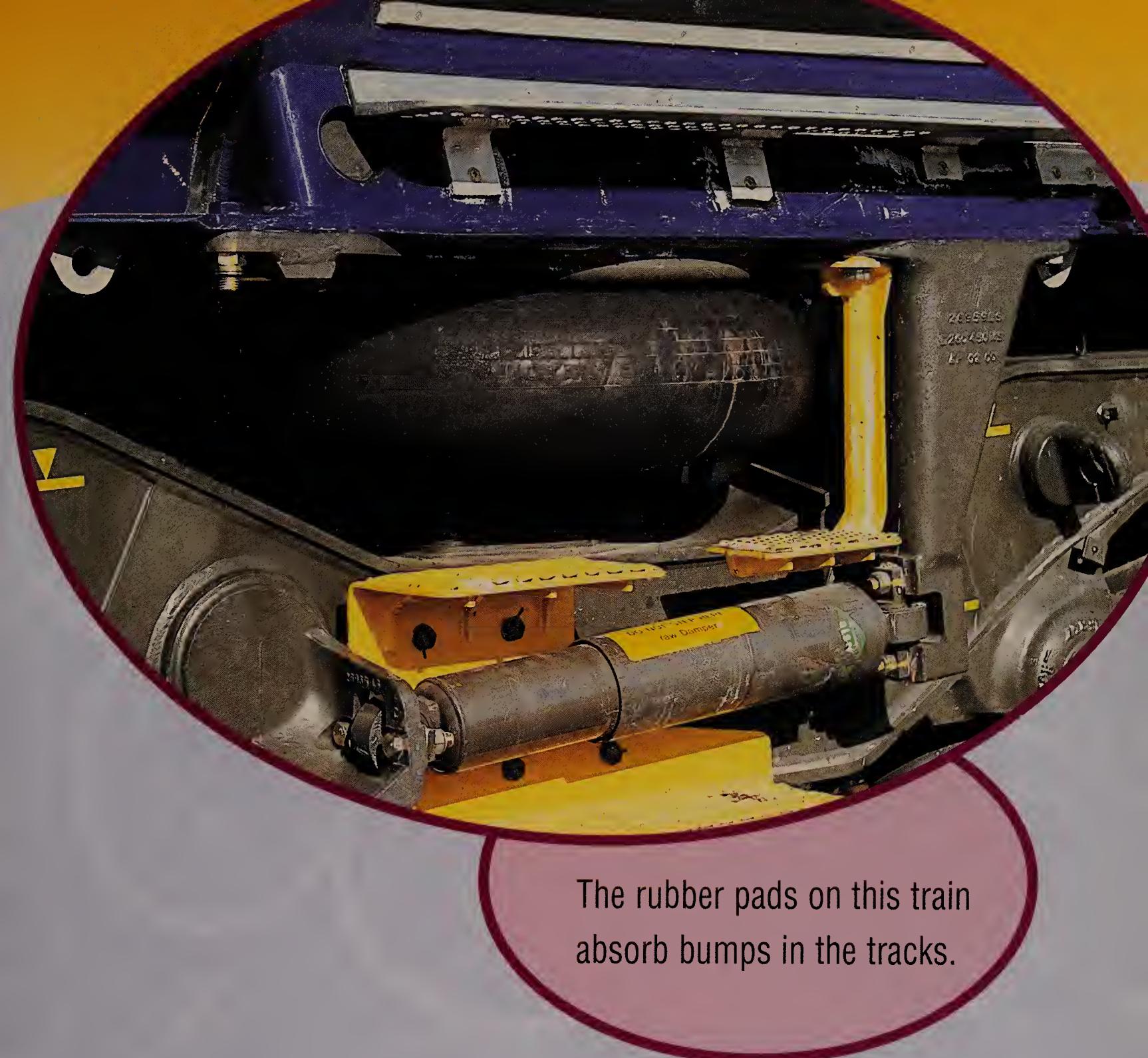
Shock-Absorbing Rubber

If you hit a piece of rubber with a hammer, the hammer bounces off without damaging it. We say that rubber is **shock-absorbent**. For example, running shoes have soles made of a **synthetic** rubber that **absorb** shocks as your feet hit the ground.

We protect objects from shocks with rubber. Some cell phones and flashlights are covered in a layer of rubber. The telephone or flashlight will be protected by the rubber if it is dropped.

Shoes worn by basketball players absorb shocks all the time during a game.

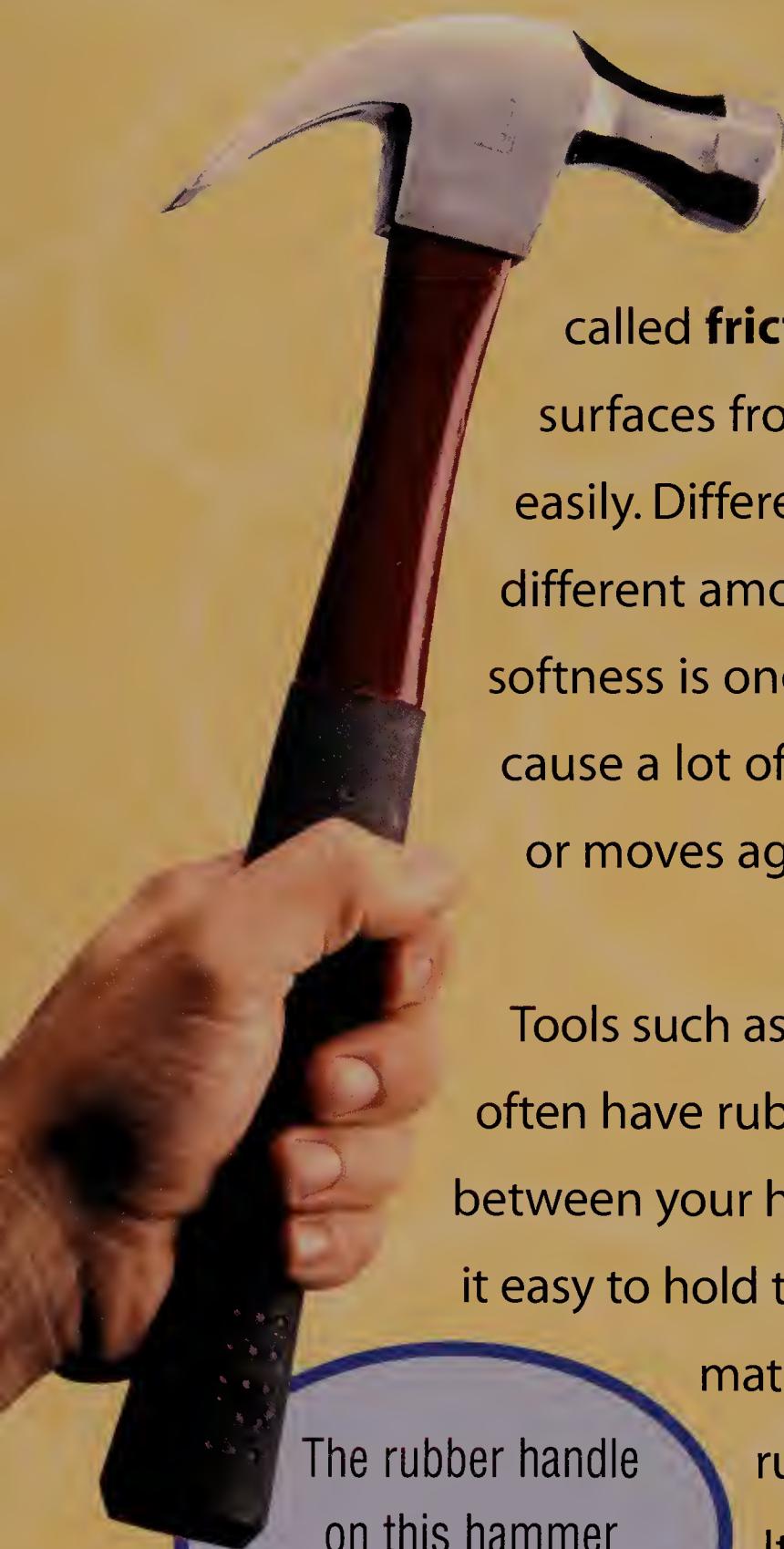




The rubber pads on this train absorb bumps in the tracks.

Some cars have rubber parts that absorb shocks as the car goes over bumps in the road. This gives people a comfortable ride. Cars and trucks have hundreds of other rubber parts. For example, the engine sits on special rubber pads. These pads keep the shaking movements from the engine from reaching the passengers.

Rubber for Friction



The rubber handle on this hammer creates friction.

When two surfaces touch or move against each other, they meet a force called **friction**. Friction stops the surfaces from sliding past each other easily. Different **materials** cause different amounts of friction. Rubber's softness is one **property** that makes it cause a lot of friction when it touches or moves against another material.

Tools such as hammers and drills often have rubber handles. The friction between your hand and the handle makes it easy to hold the tool firmly. Nonslip floor mats have rubber backing. The rubber holds on to the floor. It stops a mat from sliding when you step on it.

Rubber pads are used to slow most vehicles, from bicycles to race cars.

Rubber stops your bicycle when you pull on the brakes.

The blocks of rubber press against the metal rims of the wheels.

The friction slows the wheels until you stop.



Rubbing out

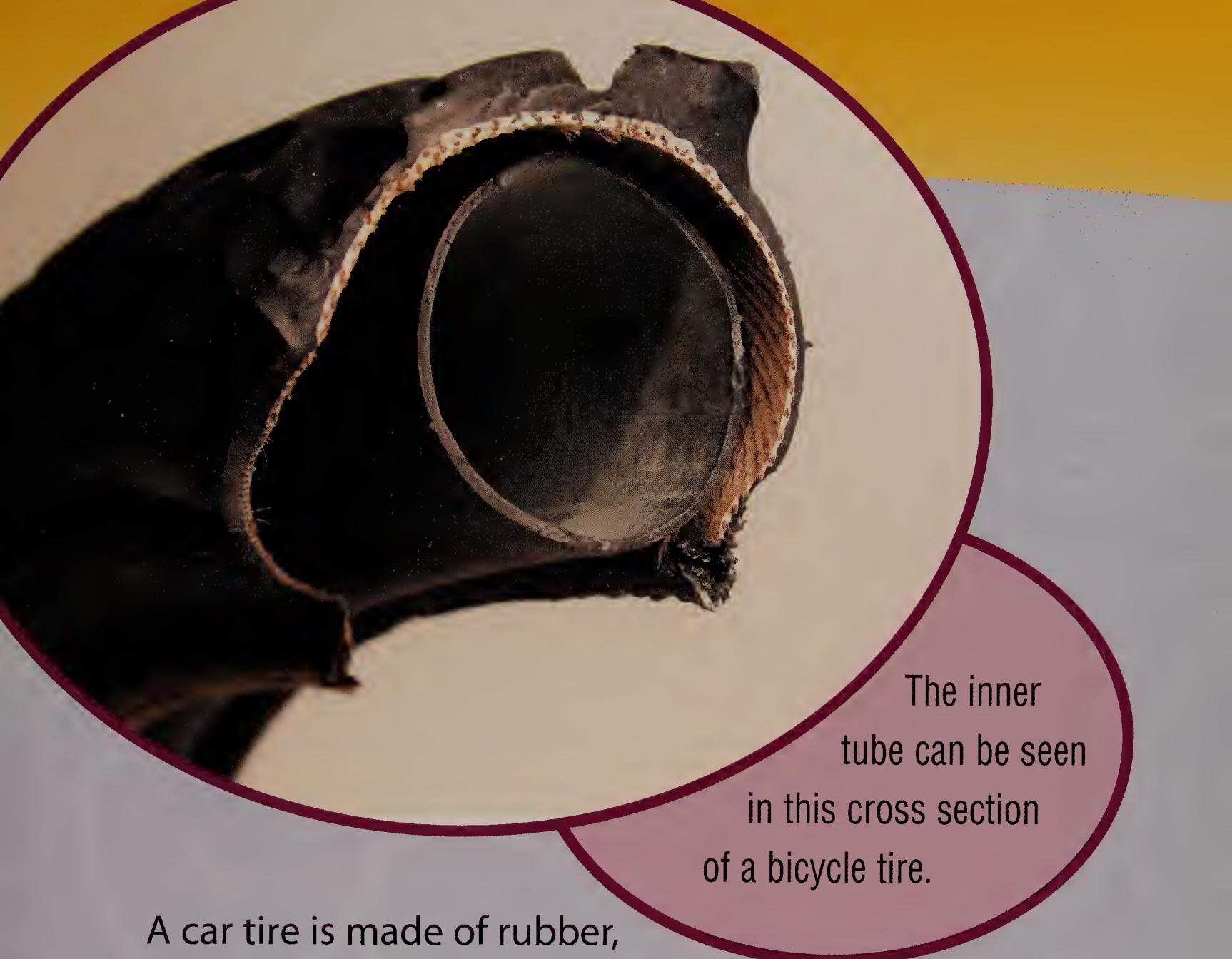
A pencil eraser is made of rubber. Rubbing the paper with the eraser wears away the surface of the paper that the pencil marks are on. This leaves fresh blank paper to write on.

Rubber Tires

Nearly half of all the rubber produced is made into tires for cars, trucks, bicycles, and other vehicles. Because rubber is **elastic**, rubber tires help smooth out the bumps in the road. Rubber tires also grip the road, stopping a vehicle from sliding as it goes around corners. Rubber is tough, so tires last a long time even though they roll along rough roads.

The huge tires on this truck smooth out rough roads.





The inner tube can be seen in this cross section of a bicycle tire.

A car tire is made of rubber, strong **fabric**, and steel wire. The fabric and wire stop the tire from bursting if it gets a hole. They also make the tire stronger. Bicycle tires have rubber inner tubes inside. When you pump up the tire, air goes into the inner tube. Some tires on trucks and buses have rubber inner tubes, too.

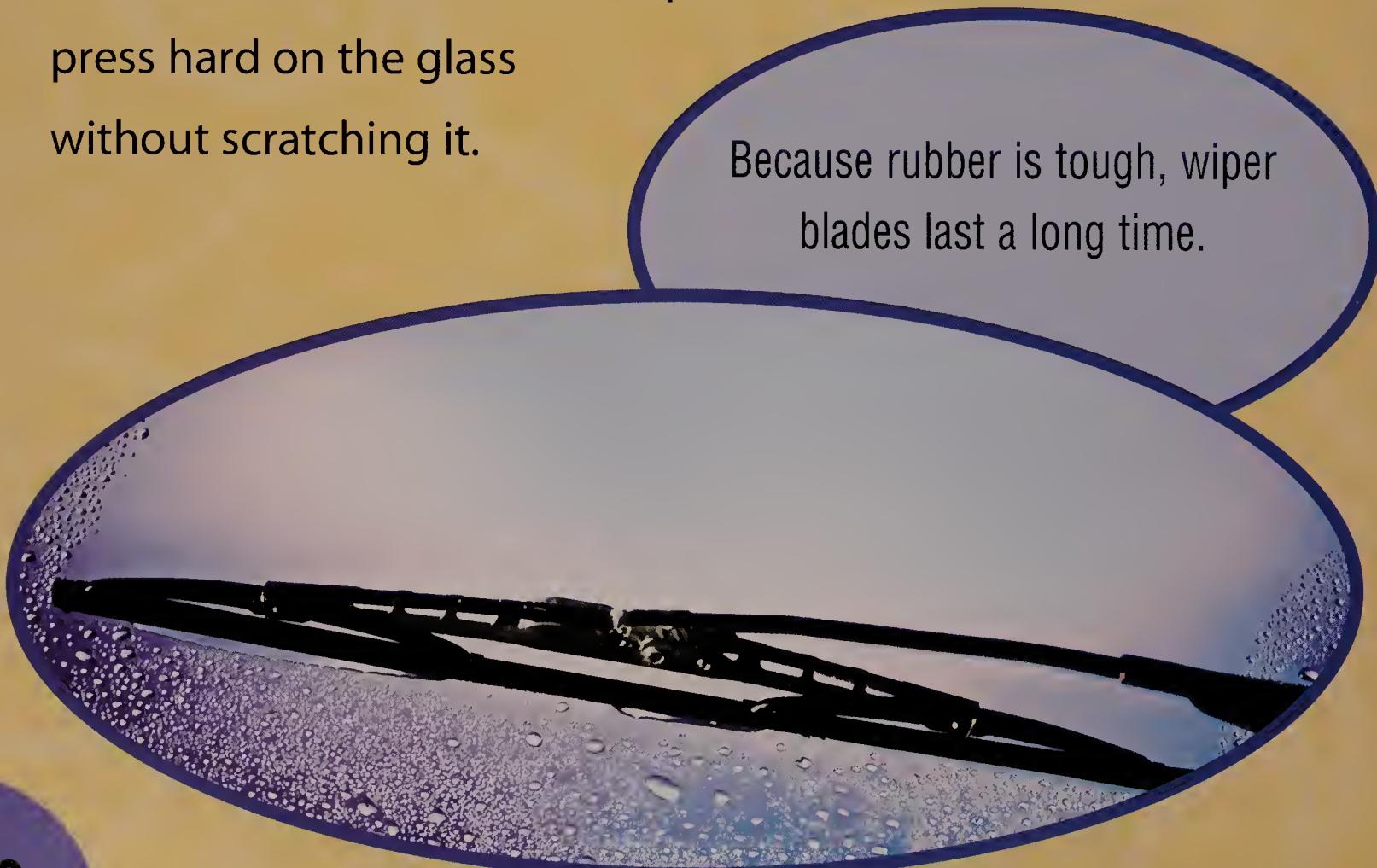
Do not use it!
Because rubber is good at gripping, we do not use it to make things that we want to be slippery. So we would not use rubber to make a playground slide.

Tough Rubber

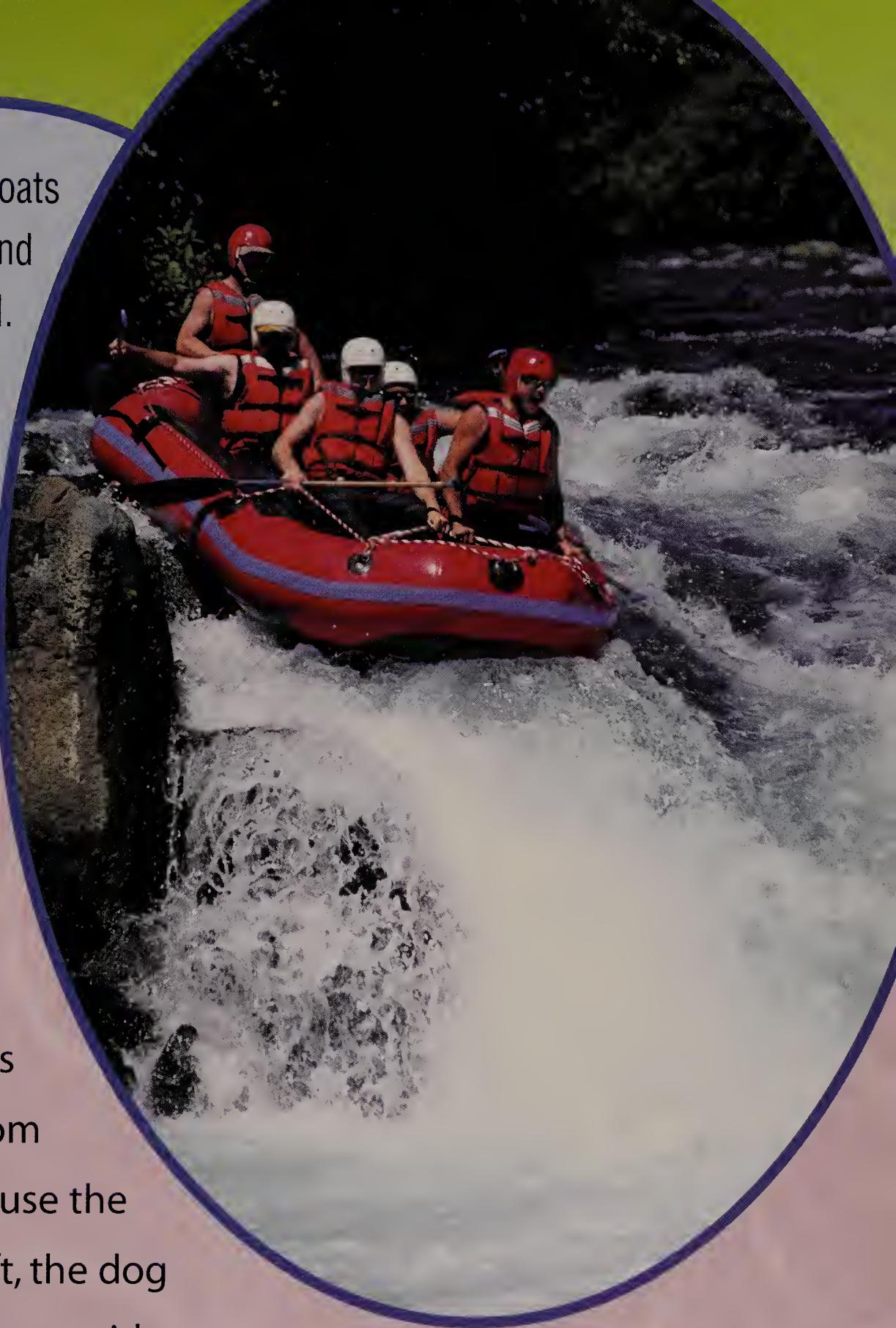
Rubber is a good **material** for car and truck tires because it is tough. It also lasts a long time. These **properties** of rubber make it useful for making many objects.

Wipers for car windshields are made from strips of rubber held along one edge by metal or plastic. The rubber strip wipes water off the glass, drying it. Rubber is bendable and soft, so the wiper can press hard on the glass without scratching it.

Because rubber is tough, wiper blades last a long time.



Rubber boats
can hit rocks and
not be damaged.
A wooden boat
would be wrecked
on rocks like
these.



Toys for dogs
are made from
rubber. Because the
rubber is soft, the dog
can hold the toy without
hurting its teeth. Because the rubber is
tough, the toy lasts a long time even if
the dog chews it.

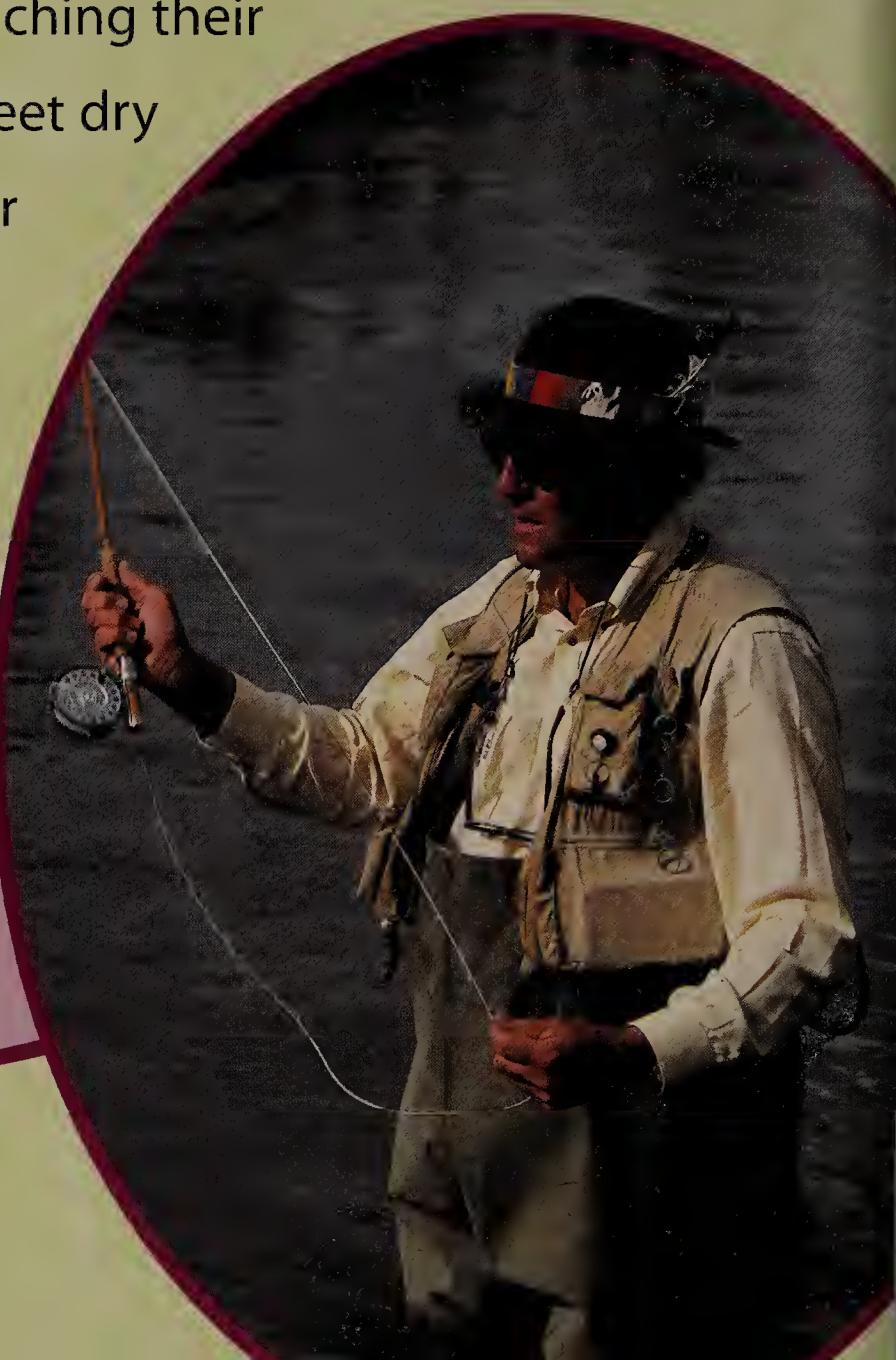
Waterproof Rubber

Rubber is **waterproof** and **airtight**. This means that water and air cannot pass through it. Rubber can be used to keep **liquids** and **gases** in and out of places.

Keeping things out

People wear rubber gloves to stop harmful **chemicals** in cleaning **materials** from touching their skin. Rubber boots keep your feet dry when it is wet. A layer of rubber can be put on clothes to make them waterproof.

This fisher is wearing waders made from a waterproof fabric.





A flexible rubber hose carries water from a faucet to the yard.

Keeping things in

A rubber hot-water bottle keeps sore body parts warm.

The tough, thick rubber means that the bottle does not burst or leak. Rubber tubes are easy to bend around corners. We use them to carry water in washing machines and engines. Hoses on fire engines are made from a strong **fabric** that is coated with rubber.

Sealing with Rubber

Rubber is **waterproof, airtight**, bendable, and tough.

These **properties** make rubber a good **material** for making stoppers and seals. These are pieces of rubber that hold **liquids** and **gases** in one place.



Rubber stoppers are used to keep liquid from spilling from bottles. The rubber squeezes slightly to give a tight fit. Airtight rubber seals on the lids of jars keep food fresh. Sink and bathtub drain plugs are made from rubber, too.

This rubber seal fits tightly against the glass tube.



The rubber used in ovens must be able to get very hot without melting.

An oven has a rubber strip around the door that keeps hot air in. A refrigerator has a seal that keeps warm air out. Car doors have rubber seals that keep water from getting in between the door and the car body. Rubber seals around doors in houses can stop drafts.

Rubber and electricity

*Rubber is a good electrical **insulator**. That means it does not let electricity flow through it. Rubber is sometimes used as an insulator to cover wires and cables. This means we can touch them safely without getting an electric shock.*

Sponge and Foam Rubber

Sponge rubber and foam rubber contain millions of tiny bubbles. Because they are mostly made of bubbles, sponge and foam rubber are very soft, springy, and light.

Sponge rubber is made by adding special **chemicals** to the rubber. When the rubber is put into a **mold** and heated, the chemicals make **gases** that form bubbles.

We use sponge rubber to make wetsuits.

The bubbles in the rubber trap warm air around a person's body.

Wetsuits keep surfers warm in the cold water.





Foam rubber is used inside these cushions to make them soft and comfortable.

Do not use it!

Sponge rubber and foam rubber are not very tough. So we do not use them to make rubber objects that need to be long lasting, such as tires.

Foam rubber is made by whipping **liquid** rubber. This mixes air into the rubber, making it frothy. The mixture is put into molds. There it sets, trapping the air. It is **vulcanized** to make it tougher. We use foam rubber to make cushions, mattresses, pillows, and soft packaging.

Rubber and the Environment

Rubber does not rot like wood or paper. If we throw rubber away, it will stay in the ground for thousands of years. Making **synthetic** rubber also uses up precious **chemicals** from **crude oil**.

Reusing rubber

We can **reuse** old rubber tires. Worn truck tires are given a new layer of rubber so they can be used again. Whole tires are made into crash barriers, playground swings, and yard containers. Tires are cut up to make rubber shapes. These are made into soles for shoes, supports for young trees, and water containers.



Rubber tires helped
save the driver
of this car
from injury.

The surface of this playground is made from recycled rubber tires.



Recycling rubber

Old tires are also **recycled** into new rubber products. Old rubber is hard to turn into fresh rubber. Instead, tires are broken into small lumps to make a **material** called crumb rubber. Crumb rubber is added to fresh rubber to make many different rubber objects, such as mats, tiles, and nonslip surfaces for playgrounds and running tracks.

Find Out for Yourself

The best way to find out more about rubber is to investigate it for yourself. Look around your home for things made from rubber, and keep an eye out for rubber during your day. Think about why rubber was used for each object. What properties make it the best one material to use? You will find the answers to many of your questions in this book. You can also look in other books and on the Internet.

Books to read

Ballard, Carol. *Science Answers: Electricity*. Chicago: Heinemann Library, 2004.

Ballard, Carol. *Science Answers: Grouping Materials*. Chicago: Heinemann Library, 2003.

Donald, Rhonda Lucas. *Recycling*. Danbury, Conn.: Scholastic Library, 2001.

Hunter, Rebecca. *Discovering Science: Matter*. Chicago: Raintree, 2003.

Llewellyn, Claire. *Rubber*. Danbury, Conn.: Scholastic Library, 2002.

Using the Internet

Explore the Internet to find out more about rubber. Have an adult help you use a search engine. Type in keywords such as *rubber plantation* and *rubber tires*.

Glossary

absorb take in

airtight describes a material that does not let air pass through it

chemical substance that we use to make other substances, or for jobs such as cleaning

crude oil oil as it is found naturally in the ground

elastic able to stretch and return to its original shape

fabric flat, bendable piece of material made from woven fibers

friction force that makes it harder for two surfaces to slide past each other

gas substance, such as hydrogen or air, with no fixed shape that expands without limit

insulator type of material that does not let electricity flow through it

latex liquid from a rubber tree that natural rubber is made from

liquid something in a runny state that can be poured from one container to another

material matter that things are made from

mold hollow shape that hot, soft rubber is pressed into to make an object

plantation area of land where trees or other crops are farmed by people

property characteristic or quality of a material

recycle use again

reuse use an object again after it has been used once

shock-absorbent able to take in and smooth out sudden shocks and bumps

strain pour through a sieve to separate a solid from a liquid

synthetic material that is made by humans

tropical from the tropics, which is an area of the world near the equator

vulcanization making rubber tougher by heating it with sulfur

washer flat, round piece of rubber that keeps water from leaking from a tap

waterproof word that describes a material that does not let water pass through it

Index

- airtight 5, 22–23, 24
- ball 13
- bicycle parts 17, 19
- boats 21
- brake pads 17
- car parts 15, 20, 25
- chemicals 7, 8, 11, 22, 26
- crude oil 8
- crumb rubber 29
- cushions 27
- door seals 11, 25
- elastic 10, 12–13, 18
- environment 28–29
- fabrics 19, 22, 23
- flashlights 14
- foam rubber 26–27
- friction 16, 17
- gloves 10, 22
- holding on 16, 18, 19
- hoses 23
- hot-water bottles 11, 23
- insulators 5, 25
- latex 6–7
- making rubber 7, 9, 11
- mats 11, 16, 29
- molds 10, 11, 26
- natural rubber 6–7
- nonslip surfaces 16, 29
- pencil erasers 7, 17
- plantations 6
- playgrounds 28, 29
- properties 5, 10, 20, 24
- recycling 29
- reusing rubber 28
- rubber bands 4, 5, 12–13
- sealing 24–25
- shock absorbing 14–15
- sink plugs 24
- special rubbers 9
- sponge rubber 26–27
- stoppers 24
- synthetic rubber 8–9, 28
- tires 11, 18–19, 28, 29
- tools 16
- tough rubber 11, 20–21, 24
- tubes 11, 23
- vulcanization 11, 27
- washers 4, 11
- waterproof 5, 7, 22–24
- wetsuits 26
- windshield wipers 20



How We Use

Rubber

Take a closer look at materials! Why are materials so important, and how do we decide which ones to use? Why is this book made from paper, and not glass? Whether heavy or light, bendable or breakable, we can find uses for almost every material on Earth. We need natural and man-made materials to make our clothes, our computers, our homes, and our schools.

This exciting series includes:

- Unusual close-up and microscopic images that take you inside materials
- Information about the properties of materials and what makes them good for some jobs, but bad for others
- A look at how we find or make materials and what this can mean for the environment
- Tips for further research, including Internet research

How We Use Rubber will give you the answers to these and many other questions:

- Where does rubber come from?
- How are rubber gloves made?
- Which trees are used to make rubber?

About the author:

Chris Oxlade is an experienced children's nonfiction author who specializes in science topics.

Titles in the series:

How We Use Coal	How We Use Rock
How We Use Cotton	How We Use Rubber
How We Use Glass	How We Use Silk
How We Use Metal	How We Use Soil
How We Use Oil	How We Use Water
How We Use Paper	How We Use Wood
How We Use Plastic	How We Use Wool

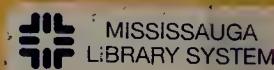
Find out about the full range of Raintree resources at www.raintreelibrary.com



9781410906045

04/03/2018 16:05:2

22



CHURCHILL
MEADOWS